PATENT
CUSTOMER NUMBER: 22,852
Attorney Docket No. 04739.0073

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
Hiroshi NAKAJIMA et al.	
Serial No.: 09/964,421	Group Art Unit: Not Assigned
Filed: September 28, 2001	Examiner: Not Assigned
For: SYSTEM FOR SUPPORTING REUSE OF HISTORY RECORDS OF DESIGN WORK	

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

APPENDIX TO PRELIMINARY AMENDMENT

Prior to examining this application, please amend the application as follows:

IN THE ABSTRACT:

ABSTRACT OF THE DISCLOSURE

In a design support system which can refer to figure element data contained in another design file, when an element ID of figure element data targeted for reference is changed or lost, a CPU retrieves a name allotted to the figure element data by a designer, the figure element data itself, one to which work instruction data matches or one having a high degree of similarity, to specify figure element data targeted for reference in order to provide a design support system which can easily specify a

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

subject to be referenced, improve [a] designing efficiency and enhance [a] overall benefit and convenience.

IN THE SPECIFICATION:

Page 1, replace the first two paragraphs after "Field of the Invention", with the following new paragraphs:

The present invention relates to a design support system which is executed by a computer, namely a CAD system, and more particularly to an improvement [of] in data management.

RELATED ARTS

CAD (computer-aided design) generally performs modeling of figures by combining basic figure elements called primitive, or by performing predetermined processing of the primitives as they are or a combination thereof. Specifically, when one edge of a cube is rounded to have a curved shape, a rounding process of that edge is performed with respect to a cube primitive to create a figure. The same figure may be created by another creating process such as extrusion processing (parallel translating body creation) of one quarter of a circle, for example.

Page 2, replace the first full paragraph and the second paragraph with the following new paragraphs:

There is used a system [that] where an ID number is determined for historical data which is referenced in [the] each design file and the figure element data created

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

therefrom, and it is used as a key to retrieve and specify the historical data or the figure element data.

However, according to the aforesaid conventional CAD system, the ID number is sometimes changed or deleted when a design file is converted so to conform to another type of CAD system or optimization processing is performed in order to reduce a load when a design file is stored. Therefore, reference to the historical data or the figure element data is disabled, and it becomes necessary to [make] create a setting for reference again, and when the figure data is comprised of many figure element data, [a] design efficiency lowers, and benefits and convenience are low.

Page 2, replace the last paragraph bridging page 3, with the following new paragraph:

The present invention is directed to a design support system, which comprises a device for managing a design file formed of a series of work procedure data, which is identified by ID and consists of at least one work procedure data portion, and figure element data to be generated on the basis of each work procedure data portion; a device for recording a work procedure data portion, which corresponds to figure element data to be referenced, as specific information linked with a standard design file by ID for identifying the work procedure data portion when reference from the standard design file to figure element data contained in another design file is determined; a first retrieval device for retrieving a corresponding work procedure data portion within another design file [with] by ID, which is recorded in the specific information, used as a key in order to retrieve the each corresponding work procedure data portion when

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

reference in the standard design file is executed; and a second retrieval device for comparing a work procedure data portion of specific information or figure element data with contents of another design file when a corresponding work procedure data portion is not retrieved by the first retrieval device and retrieving a corresponding work procedure data portion on the basis of the compared result.

Page 3, replace the last paragraph bridging page 4, with the following new paragraph:

Besides, when the figure data includes a name determined for each of various figure element data by a draftsman, the second retrieval device desirably retrieves figure element data targeted for reference with figure data as specific information used as a key by comparing names determined by the draftsman.

Page 4, replace the first full paragraph with the following new paragraph:

The present invention is also directed to a design support method, which comprises managing a design file formed of a series of work procedure data, which is identified by ID and consists of at least one work procedure data portion, and figure element data to be generated on the basis of each work procedure data portion; recording a work procedure data portion, which corresponds to figure element data to be referenced, as specific information linked with a standard design file by ID for identifying the work procedure data portion when reference from the standard design file to f figure element data contained in another design file is determined; retrieving a corresponding work procedure data portion within another design file [with] by ID, which

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

is recorded in the specific information, used as a key in order to retrieve [the] each corresponding work procedure data portion when reference in the standard design file is executed; and comparing a work procedure data portion of specific information or figure element data with contents of another design file when a corresponding work procedure data portion is not retrieved by the retrieval and retrieving a corresponding work procedure data portion on the basis of the compared result.

Page 5, replace the first paragraph after "Description of the Preferred Embodiment", and all of the following paragraphs bridging pages 5-12, with the following new paragraphs:

An embodiment of the present invention will be described with reference to the accompanying drawings. The design support system according to the embodiment of the present invention is basically comprised of a CPU 11, a storage section 12, a hard disk 13, a display control section 14, an input operation section 15 and a removable drive 16 as shown in Fig. 1. The CPU 11 implements a device for managing design files, a device for recording ID in a design file used as a standard, a device for recording specific information, a first retrieval device and a second retrieval device.

According to a drawing instruction input from the input operation section 15, the CPU 11 records as work procedure data a working view at a time when the drawing instruction was given and the input drawing instruction in order. The CPU 11 also creates figure element data to be created as a drawing according to the aforesaid drawing instruction, and records the work procedure data and the drawing element data in a related form as a file of the design file [into] in the storage section 12. This work

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

procedure data is specifically the one [as] shown in Fig. 2. In other words, when a figure is created, an element ID is allocated to each figure element data and recorded into every work procedure data corresponding, and an instruction related to the designation of a work environment, such as a change of the working view, is also recorded. Besides, when the designer gives a name to a figure to be created according to [the] each figure element data (e.g., a name such as "cylindrical column 1" is given), this name is included in the figure element data and recorded [into] in the work procedure data.

When the CPU 11 receives as part of the drawing instruction an instruction to refer to the figure element data contained in another design file stored on the hard disk 13, it takes this instruction [of] to [referring as,]refer to work procedure data and records the referenced figure element data as specific information. At this time, it is also desirable that the CPU 11 includes at least any of the [name] names given by the designer, the pertinent figure element data itself or the work procedure data corresponding to the figure element data, in addition to the element ID of the figure element data to be referenced, [into] in the specific information. The specific information is desirably recorded on the hard disk 13 as a file different from the design file to be a standard (the design file to be a standard will be hereinafter called "standard design file"). [It] This is because all figure element data contained in the specific information are not always referenced. In other words, when a plurality of figure element data are contained in the specific information and a work procedure data portion for creating such figure element data is also contained therein, all the work procedure data portions are not always used in the standard design file, so that it is

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

more efficient to record as a separate file. [But] However, where it is not necessary to consider the efficiency or where all the work procedure data portions are referenced, the specific information may be contained and recorded in the standard design file.

In addition, upon receiving input of an instruction to renew the standard design file containing the instruction for referencing, the CPU 11 performs reprocessing of the work procedure data contained in the standard design file to reproduce [the] each figure element data and reconfigures (regenerates) the whole figure data. Here, if a command (substitution command) for instructing recreation of a drawing based on the work procedure data being referenced is input while work procedure data contained in another design file in the work procedure data is being referenced, retrieval processing of the work procedure data is performed, and according to the retrieved drawing instruction, the figure element data is reproduced, and the figure data is recreated.

First, the figure element data retrieval processing by the CPU 11 specifies an element ID of the standard element data being referenced in the work procedure data portion within the specific information. Using the specified element ID as a key, a corresponding work procedure data portion is retrieved from another design file which is newly referenced. Thus, the subjects to be retrieved are narrowed to enhance ~~an~~ efficiency. Here, when a corresponding element ID in another design file is changed or lost, work procedure data for a reference targeted for reference is retrieved according to the specific information.

Specifically, when a substitution command is input, the CPU 11 retrieves the corresponding work procedure data with reference to the element ID targeted for reference, and when the work procedure data cannot be retrieved by the element ID,

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

the processing shown in Fig. 3 is started to search for figure element data having a name matching [to] the name given by the designer (S1) . Here, if there is [not] no figure element data having a matching name (if No) , a search is performed for the presence or absence of the recorded figure element data itself or one corresponding to the work procedure data (S2). This step S2 compares, for example, a command (a command designating a primitive of "creation of a cylindrical column" or the like, an instruction command such as "fillet", a "Boolean operation" or the like) included in the work procedure data and its parameter (coordinates, a computation instruction such as "difference", "product" or the like) or compares the figure element data (its shape data, position, coordinates, etc.) to retrieve a matching one.

If there is no matching data found in the step S2 (if No), the CPU 11 checks similarity of the recorded figure element data itself or the work procedure data and retrieves one having a high degree of similarity (S3). The similarity here means, for example, a difference in parameter of the work procedure data, a difference in position of the figure element data, a difference in coordinates, etc. Where the similarity is defined by such a difference, retrieval is performed assuming that one having the smallest difference has a high degree of similarity. In the step S3, it is also [suitable] appropriate to assume that a similar one has been retrieved only when the similarity is lower than a previously determined threshold value (e.g., only when a difference in parameter is smaller than the predetermined threshold value).

If nothing having a high degree of similarity is found in the step S3 (if No) , the processing is terminated. It is also [suitable that] appropriate for the CPU 11 [indicates]

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

to show a message on the display control section 14 indicating that a substitution object was not found.

Meanwhile, if a matching one or one with high similarity is retrieved in the Step S1, S2 or S3 (if Yes), the retrieved work procedure data is newly recorded as specific information. [And] Also, figure element data is prepared based on the recorded specific information, and figure data as a whole is re-created (S4). Then, the CPU 11 terminates the retrieval processing.

The storage section 12 operates as a work memory of the CPU 11. The hard disk 13 stores and manages the design file as a file based on the instruction from the CPU 11 and reads the design file to output to the CPU 11. [And the] The hard disk 13 also stores the program executed by the CPU 11. The display control section 14 is a display or the like and shows figure data or work instruction data on the basis of the instruction from the CPU 11. The input operation section 15 is a keyboard, a mouse or the like from which the CPU 11 receives input of the instruction. The removable drive 16 reads a program from a recording medium which can be read by a computer. [And the] The CPU 11 also carries out [processes] processing to install the read program on the hard disk 13.

In the [aforesaid] aforementioned description, data compared in the step S2 or the step S3 was described as data forming the figure element, but data before and after the aforesaid data, such as a drawing instruction of extension lines previously prepared when the figure element is drawn, are included into the aforesaid data and compared. Besides, in a case of a cylindrical column for example, there are a plurality of creation methods (input patterns) [that] where a circle and extrusion of the circle are instructed

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

with respect to, for example, a cylindrical column creation command in addition to designation of the cylindrical column creation command and parameters of a radius and a length. Therefore, whether the input patterns match or not is also a standard for comparison in the step S2 or the Step S3.

[Then, an] An operation of the design support system of the embodiment will be described. First, it will be described assuming that a design file of the cylindrical column shown in Fig. 4A and the standard design file showing the figure consisting of the cylindrical column and the cube shown in Fig. 4B with reference to the cylindrical column design file are stored on the hard disk 13. [To] For the cylindrical column design file, it is determined that element ID = 1, a "circle creation" command and a radius as its parameter are designated, then a "parallel translating body creation" command and a parallel translating length are designated as its parameter [are designated], and they are included as work instruction data. [And] Also, data of a figure element (cylindrical column) to be created according to the work instruction data is associated. Here, the figure element data is a solid model and data shown by a well-known boundary representation or the like, but its shape is shown as it is in Fig. 4A, Fig. 4B and Fig. 4C for convenience of description. Here, recording of the specific information into the standard design file will be exemplified.

Referring to the cylindrical column design file, a reference command for referencing the figure element of the element ID = 1, specific information comprising work instruction data to be referenced, a command for creating a cube with an element ID = n_1 and parameters of coordinates at the top and length of the cube are contained as work instruction data in the design file indicating the figure consisting of the

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

cylindrical column and the cube. [And] Also, the figure element data created accordingly is associated. Fig. 4B shows a state [that] where figure data combining the figure element data of the cylindrical column taken for reference and the figure element data of the cubic is stored together with the work instruction data.

Here, by an operation to convert the file of Fig. 4A into another file format to work, the element ID contained in the work instruction data may be varied or lost. For example, it is assumed that a "circle creation" command is changed to a "square creation" command by another file format and the original cylindrical column shape is changed into a rectangular parallelepiped shape according to the "square creation" and the "parallel translating body creation". In this case, the design file of Fig. 4A has the element ID lost as shown in the design file of Fig. $4C_1$ for example, contains as the work instruction data the "square creation" and "parallel translating body creation" commands and their parameters, and has a state with figure element data of a rectangular parallelepiped shape related. It is assumed that a radius parameter for creating a circle and an edge length parameter for creating the square have the same value and the parameter of a length to the parallel translating body creation command is not changed.

When the designer executes a substitution command while processing the standard design file of Fig. 4B in the [aforesaid] aforementioned state, the CPU 11 takes the figure element data corresponding to the element ID = 1, but since the element ID has been lost, the processing of retrieving the subject to be referenced shown in Fig. 3 is started. The CPU 11 checks first whether there is a name given by the designer. [Cut] However, there is [not a] no name allotted to the figure element because the work instruction data does not have a name setting work. Therefore, the

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

CPU 11 references the work instruction data or the figure element data itself to search for a matching figure. [But] However, there is [not a] no matching figure because the work instruction has been changed from the cylindrical column to the rectangular parallelepiped. The CPU 11 then searches for the work instruction data or the figure element data having a higher degree of similarity. The work instruction data (data shown in Fig. 4C) having a high degree of similarity, which comprises a procedure of creating a two-dimensional shape having a matching value of the parameter with respect to the parallel translating body creation and substantially the same size and translating it to create a column, is retrieved, and according to the retrieved work instruction data, figure element data is re-created, figure data as a whole is re-created, and the re-created results are displayed and stored.

While there has been described that what is at present considered to be a preferred embodiment of the invention, it is to be understood that various modifications may be made thereto, and it is intended that the appended claims cover all such modifications as fall within the true spirit and scope of the invention.

IN THE CLAIMS:

7. (Amended) A design support method, comprising:

managing a design file formed of a series of work procedure data, which is identified by ID and consists of at least one work procedure data portion, and figure element data to be formed on the basis of each work procedure data portion;

recording a work procedure data portion, which corresponds to figure element data to be referenced, as specific information linked with a standard design file by ID for

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

identifying the work procedure data portion when reference from the standard design file to figure element data contained in another design file is determined;

retrieving a corresponding work procedure data portion within another design to file with ID, which is recorded in the specific information, used as a key in order to retrieve [the] each corresponding work procedure data portion when reference in the standard design file is executed; and

comparing a work procedure data portion of specific information or figure element data which contents of another design file when a corresponding work procedure data portion is not retrieved by the retrieval and retrieving a corresponding work procedure data portion on the basis of the compared result.

8. (Amended) A recording medium storing a design support program and being computer-readable[, wherein the design support program contains the following] comprising:

a module for managing a design file formed of a series of work procedure data, which is identified by ID and consists of at least one work procedure data portion, and figure element data to be formed on the basis of each work procedure data portion;

a module for recording a work procedure data portion, which corresponds to figure element data to be referenced, as specific information linked with a standard design file by ID for identifying the work procedure data portion when reference from the standard design file to figure element data contained in another design file is determined;

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000

a first retrieval module for retrieving a corresponding work procedure data portion within another design file with ID, which is recorded in the specific information used, as a key in order to retrieve the each corresponding work procedure data portion when reference in the standard design file is executed; and

a second retrieval module for comparing a work procedure data portion of specific information or figure element data with contents of another design file when a corresponding work procedure data portion is not retrieved by the first retrieval module and retrieving a corresponding work procedure data portion on the basis of the compared result.

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, DC 20005
202-408-4000